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(19)(CA) **APPLICATION FOR CANADIAN PATENT** (12)

(54) Friction Rock Stabilizers

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(57) 7 Claims

ABSTRACT OF THE DISCLOSURE

A rock stabilizer of this invention includes an elongated metal tube, which is substantially circular in cross-section and a circumferential outwardly projecting stop at or adjacent one end of the tube and is characterised in that the stabilizer tube includes an open slot which extends over the length of the tube and through the stop to enable the tube and the stop to be reduced in diameter by closure of the slot in use and a metal ring which at least partially surrounds the tube and extends across the slot at the stop with the tube being movable relatively to the ring in its circumferential direction to enable the tube and stop to be reduced in diameter in use. Conveniently the stop is integral with the tube material and is provided by shortening the tube in the zone of the stop.

FIELD OF THE INVENTION

This invention relates to tubular friction rock stabilizers which are used for controlling stress induced fracturing and strain bursts in rock in underground mining or tunnelling operations and in general ground support applications.

BACKGROUND TO THE INVENTION

Friction rock stabilizers which include elongated metal tubes which carry at one end a radially projecting stop and are slotted over their lengths are known. Many of the known stabilizers carry metal rings which either form the stop at the end of the tube or are located adjacent the stop and are circumferentially welded to the outer surface of the tube. A problem with these stabilizers, particularly if they are of the type in which the tube slot is an open slot to enable the tube to be compressed to a smaller diameter on its insertion into a predrilled rock hole of a slightly smaller diameter than the tube, is that the welded ring does not permit the slot to close at the mouth of the tube by holding the stop and a portion of the tube adjacent the stop at its original diameter which either prevents the tube from being fully fed into the hole until the stop abuts the rock face which carries the hole and or the larger diameter portion of the tube causes

spalding of the rock at the mouth of the hole. With stabilizer tubes of this type which do not include the rings it frequently happens that the dollies which are located in the mouths of the tubes, and with which the tubes are hammered into the holes, skew in the tube bores, particularly while the end of the tube is remote from the hole, to destructively breach the tube walls through the slots in the tubes. This problem arises as the tube slots may be as wide as 15mm before closure and the stabilizers are often pressed into the holes from awkward positions. The breached tubes are generally damaged to such an extent that the stabilizers are unserviceable and tediously have to be withdrawn from holes in which they are partially located.

SUMMARY OF THE INVENTION

A rock stabilizer according to the invention includes an elongated metal tube, which is substantially circular in cross-section and a circumferential outwardly projecting stop at or adjacent one end of the tube and is characterised in that the stabilizer tube includes an open slot which extends over the length of the tube and through the stop to enable the tube and the stop to be reduced in diameter by closure of the slot in use and a metal ring which at least partially surrounds the tube and extends across the slot at the stop with the tube being movable relatively to the ring in its circumferential direction to enable the tube and stop to be

reduced in diameter in use. Conveniently the stop is integral with the tube material and is provided by shortening the tube in the zone of the stop.

In one form of the invention the tube material at the mouth of the tube is folded outwardly from the bore of the tube and back towards the outer surface of the tube to define a substantially annular cavity in the stop with the ring being C-shaped and located in the stop cavity across the open slot with its free ends spaced from each other in the cavity opposite the slot.

Further according to the invention a portion of the tube from its mouth is outwardly belled with the stop being situated on the belled portion of the tube.

In another form of the invention the stop is substantially U-shaped in cross-section and may be spaced a short distance from the mouth of the tube. In this form of the invention the ring is attached to the tube.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is now described by way of example only with reference to the drawings in which:

FIGURE 1 is a plan view of one embodiment of the rock stabilizer of the invention,

FIGURE 2 is an enlarged end elevation of the rock stabilizer of Figure 1,

FIGURE 3 is a fragmentary side elevation of the rock stabilizer of Figures 1 and 2 shown sectioned on the line 3-3 in Figure 2, and

FIGURE 4 is a sectioned side elevation of a second embodiment of the rock stabilizer of the invention.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

The rock stabilizer 10 of the invention is made from a suitable resilient steel such as ASPM A607 Grade 60 Class 1 and as with conventional rock stabilizers has an outer diameter typically between 32mm and 48mm, a wall thickness of between 2,3mm and 3,2mm and the length of anything between 0,9 to 4 metres.

The rock stabilizer of Figures 1 to 3 consists of a generally parallel sided elongated metal tube 12 which is inwardly tapered at one end over a portion of its length 14 and which carries, at its other end, a stop arrangement 16 to prevent the mouth of the stabilizer tube entering the

hole in which the stabilizer is to be used, and in some applications, for holding a roof washer or bearing plate against the rock surrounding the hole mouth when the stabilizer is fully driven into the hole. The stabilizer additionally carries an open slot 18 which extends over the length of the tube including the portion of the tube which carries the stop 16.

The stop 16, as is more clearly seen in Figures 2 and 3, comprises an outwardly belled tube portion 20 at the mouth of the tube and an outward scroll 22 which is formed by folding the material at the mouth of the belled portion of the tube outwardly and the back towards the tube to provide a cavity 24 in the scroll. A closure ring 26 which is made from a resilient steel and is C-shaped as is shown in Figure 2, is located in the scroll 22 as it is formed with a portion of the ring bridging the tube slot 18 and its free ends located in the scroll cavity as illustrated in Figure 2.

In the Figure 4 embodiment of the rock stabilizer of the invention the stop arrangement 16 consists of an outwardly projecting U-shaped rib 28 which is formed by upsetting the tube towards its end as shown in the drawing and a closure ring 30. In this embodiment of the invention the closure ring 30 is a continuous ring and may be either frictionally attached to the tube 12 against the rib 28 or may be loosely located on the tube and tack welded to the outer surface of the tube preferably opposite the slot 18 so that as the slot is closed in use the material of the tube is free to move to

closure of the slot relatively to the ring.

In use, the stabilizer tubes of the invention are located in predrilled holes of smaller diameter than the outer diameters of the tubes 12 by locating suitable dollies in the mouths of the tubes and pressing the stabilizers by means attached to the dollies into the holes. The smaller diameter holes cause the slots 18 in the tubes at least partially to close progressively against the resilience of the metal from which the tubes are made as the tubes are pressed into the holes with the tube resilience outwardly biasing the tubes firmly into frictional engagement with the walls of the holes. The rings 26 and 30 minimise the possibility of the dollies skewing from the bores of the tubes 12 through the slots 18 while the stops on the stabilizer tubes are well outside the mouths of the holes with their slots still wide open.

As the stop 16 of the tube 12 of the Figures 1 to 3 stabilizer approaches the mouth of the hole into which the stabilizer is being pressed the scroll 22 of the stop closes around the ring in the direction of the arrows in Figure 2 to enable the tube adjacent the stop and the stop itself to be reduced in diameter without damage to the tube or the rock surrounding the mouth of the hole as the stop is driven up against the rock face surrounding the hole.

In the Figure 4 embodiment of the rock stabilizer the tube is merely closed to a smaller diameter inside the ring 30.

The invention is not limited to the precise details as herein described and the stop 16 of the rock stabilizer of the invention could have any suitable shape which will perform the function of the stops 22 and 28 as described above.

CLAIMS

1. A rock stabilizer including an elongated metal tube, which is substantially circular in cross-section and a circumferential outwardly projecting stop at or adjacent one end of the tube, characterised in that the stabilizer tube includes an open slot which extends over the length of the tube and through the stop to enable the tube and the stop to be reduced in diameter by closure of the slot in use and a metal ring which at least partially surrounds the tube and extends across the slot at the stop with the tube being movable relatively to the ring in its circumferential direction to enable the tube and stop to be reduced in diameter in use.

2. A rock stabilizer as claimed in claim 1 in which the stop is integral with the tube material and is provided by shortening the tube in the zone of the stop.

3. A rock stabilizer as claimed in claim 2 in which; the tube material at the mouth of the tube is folded outwardly from the bore of the tube and back towards the outer surface of the tube to define a substantially annular cavity in the stop with the ring being C-shaped and located in the stop cavity across the open slot with its free ends spaced from each other in the cavity opposite the slot.

4. A rock stabilizer as claimed in claim 3 in which a portion of the tube from its mouth is outwardly belled with the stop being situated on the belled portion of the tube.

5. A rock stabilizer as claimed in claim 2 in which the stop is substantially U-shaped in cross-section.

6. A rock stabilizer as claimed in claim 5 in which the ring is attached to the outer surface of the tube.

7. A rock stabilizer as claimed in claimed in claim 5 in which the ring is a loose fit over the tube and is attached to the tube by a tack weld.

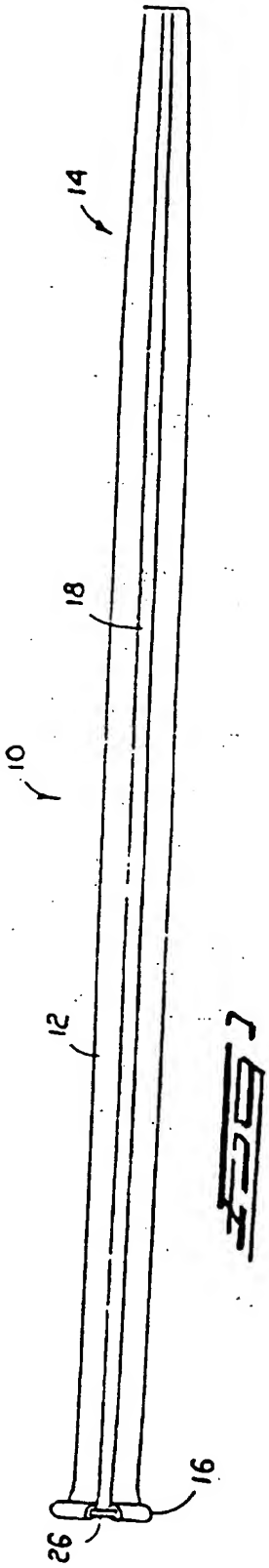

FIG 1

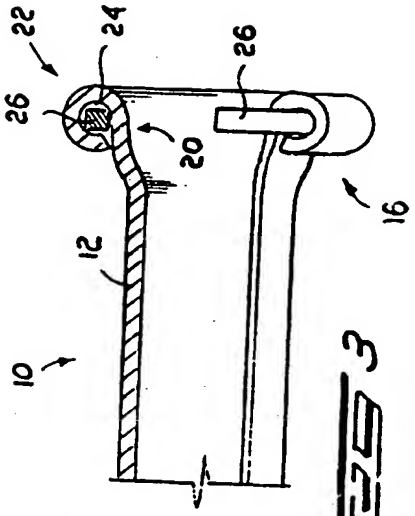

FIG 3

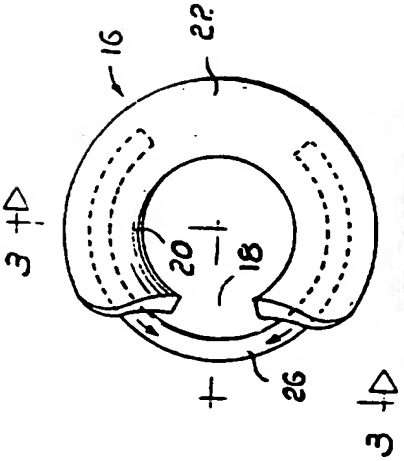

FIG 2

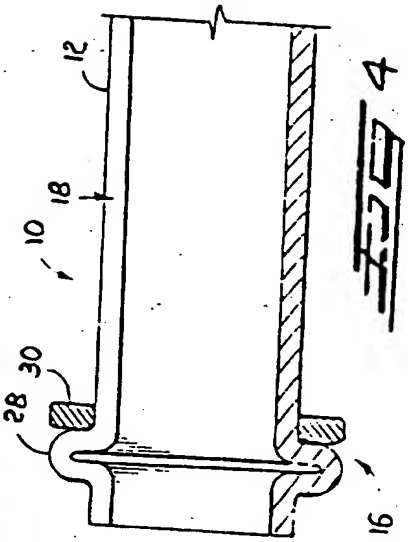

FIG 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CA2004/001878

A. CLASSIFICATION OF SUBJECT MATTER

E21D-21/00, E21D-20/00

According to International Patent Classification (IPC) or to both national classification and IPC 7

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Base de données de brevets Canadiens

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

CIB E21D-21/00, 20/00; USPC 405, 411

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

Delphion (elastic, expansion, elast*, expan*)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	US 6,273,655 (McAlpine et col.) 14 août 2001	
X Y	colonne 1, ligne 66 à colonne 2, ligne 7 colonne 5, lignes 19 à 38 colonne 6, lignes 11 à 31 figures 1 à 5	1-4, 9, 10, 12, 13, 16-18 11, 14, 15
	US 3,651,651 (Triplett) 28 mars 1972	
X Y	colonne 1, ligne 71 à colonne 2, ligne 67 figures 1, 4 et 5	1-4, 9, 12, 13, 16-18 14, 15
	US 4,472,088 (Martin) 18 sept. 1984	
X Y	colonne 2, lignes 32 à 59 colonne 3, lignes 10 à 54 figures 1 et 2	1-4, 9, 12, 13, 16-18 14, 15
	CA 2,342,707 (Boozer et col.) 4 octobre 2001	
Y	page 4, lignes 1 à 4 page 5, lignes 1 à 3	11

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
	07 mars 2005 (07-03-2005)
Name and mailing address of the ISA/ Commissaire aux brevets Bureau Canadien des brevets Facsimile No. Boîte PCT, Ottawa/Gatineau K1A 0C9	Authorized officer Patrick Cyr (819) 953-1304 Telephone No.

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CA2004/001878

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 4,631,889 (Adam et col.) 30 décembre 1986 colonne 1, lignes 54 à 61	14
Y	CA 2,180,878 (Swemmer) 11 janvier 1998 page 2, ligne 15 à page 3, ligne 2	15

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/CA2004/001878

Patent document cited in search report	Publication date	Patent familiy member(s)	Publication date
US6273655	14-08-2001	AT242437T T	15-06-2003
		AU736273 B2	26-07-2001
		AU8991498 A	22-03-1999
		CA2304486 A1	11-03-1999
		DE69815366D D1	10-07-2003
		DE69815366T T2	29-04-2004
		EP1019639 A1	19-07-2000
		ES2201523T T3	16-03-2004
		GB9718733D D0	12-11-1997
		US6273655 B1	14-08-2001
		WO9911940 A1	11-03-1999
US3651651	28-03-1972	AUCUN	
US4472088	18-09-1984	AUCUN	
US4631889	30-12-1986	GB2132299 A	04-07-1984
		US4631889 A	30-12-1986
CA2342707	04-10-2001	AU742400 B2	03-01-2002
		CA2342707 A1	04-10-2001
		DE10116447 A1	06-12-2001
		US6599059 B2	29-07-2003
		ZA200102762 A	04-11-2002
CA2180878	11-01-1998	AUCUN	